



SEQUENCE LISTING

<110> Holly, Hogrefe
Connie, Hansen J

<120> Polymerase Enhancing Factor (PEF) extracts, PEF protein
complexes, isolated PEF protien, and methods for purifying and
identifying them

<130> 04121.0116-01000

<140> 08/957,709

<141> 1997-10-24

<150> 08/822,774

<151> 1997-03-21

<160> 104

<170> PatentIn version 3.3

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Asn Gln Val Val Leu Ile Gly Arg
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Arg Lys

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Glu

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Ile Glu

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 atagtcnnnn nnnnccagg gagtattgcg gctttggatg tgaaagcttg tgagggacta 120
 attaggcatg gggccgaagt tcatgcagtg atgagtgagg cagccaccaa gataattcat 180
 ccttatgcat ggaatttgcc cacgggaaat ccagtcataa ctgagatcac tggatttatc 240
 gagcatgttg agttagcagg ggaacatgag aataaagcag atttaatttt ggtttgcct 300
 gccactgcca acacaattag taagattgca tgtggaatag atgatactcc agtaactaca 360
 gtcgtgacca cagcatttcc ccacattcca attatgatag ccccagcaat gcatgagaca 420
 atgtacaggc atcccatagt aagggagaac attgaaaggt taaagaagct tggcgttgag 480
 tttataggac caagaattga ggagggaaag gcaaaagttg caagcattga tgaaatagtt 540
 tacagagtta ttaaaaagct ccacaaaaaa acattggaag ggaagagagt cctagtaacg 600
 gcgggagcaa caagagagta catagatcca ataagattca taacaaatgc cagcagtgga 660
 aaaatgggag tagcgttggc tgaagaagca gatttttagag gagctgttac cctcataaga 720
 acaaagggaa gtgtaaaggc ttttagaatc agaaaaatca aattgaaggt tgagacagtg 780
 gaagaaatgc tttcagcgat tgaaaatgag ttgaggagta aaaagtatga cgtagttatt 840

atggcagctg ctgtaagcga ttttaggccaa aaaattaaag cagagggaaa aattaaaagc 900
 ggaagatcaa taacgataga gctcgttcn nnaatccca aaatcattga tagaataaag 960
 gaaattcaac caaatgtctt tcttggttga tttaaagcag aaacttcaaa agaaaagctt 1020
 atagaagaag gtaaaaggca gattgagagg gccaaggctg acttagtcgt tggtaacaca 1080
 ttggaagcct ttggaagcga ggaaaaccaa gtagtattaa ttggcagaga tttcacaaaa 1140
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Asp Val Lys Ala Cys Glu Gly Leu Ile Arg His Gly Ala Glu Val His
 35 40 45

Ala Val Met Ser Glu Ala Ala Thr Lys Ile Ile His Pro Tyr Ala Trp
 50 55 60

Asn Leu Pro Thr Gly Asn Pro Val Ile Thr Glu Ile Thr Gly Phe Ile
 65 70 75 80

Glu His Val Glu Leu Ala Gly Glu His Glu Asn Lys Ala Asp Leu Ile
 85 90 95

Leu Val Cys Pro Ala Thr Ala Asn Thr Ile Ser Lys Ile Ala Cys Gly
 100 105 110

Ile Asp Asp Thr Pro Val Thr Thr Val Val Thr Thr Ala Phe Pro His
115 120 125

Ile Pro Ile Met Ile Ala Pro Ala Met His Glu Thr Met Tyr Arg His
130 135 140

Pro Ile Val Arg Glu Asn Ile Glu Arg Leu Lys Lys Leu Gly Val Glu
145 150 155 160

Phe Ile Gly Pro Arg Ile Glu Glu Gly Arg Ala Lys Val Ala Ser Ile
165 170 175

Asp Glu Ile Val Tyr Arg Val Ile Lys Lys Leu His Lys Lys Thr Leu
180 185 190

Glu Gly Lys Arg Val Leu Val Thr Ala Gly Ala Thr Arg Glu Tyr Ile
195 200 205

Asp Pro Ile Arg Phe Ile Thr Asn Ala Ser Ser Gly Lys Met Gly Val
210 215 220

Ala Leu Ala Glu Glu Ala Asp Phe Arg Gly Ala Val Thr Leu Ile Arg
225 230 235 240

Thr Lys Gly Ser Val Lys Ala Phe Arg Ile Arg Lys Ile Lys Leu Lys
245 250 255

Val Glu Thr Val Glu Glu Met Leu Ser Ala Ile Glu Asn Glu Leu Arg
260 265 270

Ser Lys Lys Tyr Asp Val Val Ile Met Ala Ala Ala Val Ser Asp Phe
275 280 285

Arg Pro Lys Ile Lys Ala Glu Gly Lys Ile Lys Ser Gly Arg Ser Ile
290 295 300

Thr Ile Glu Leu Val Pro Xaa Asn Pro Lys Ile Ile Asp Arg Ile Lys
305 310 315 320

Glu Ile Gln Pro Asn Val Phe Leu Val Gly Phe Lys Ala Glu Thr Ser
325 330 335

Lys Glu Lys Leu Ile Glu Glu Gly Lys Arg Gln Ile Glu Arg Ala Lys
340 345 350

Ala Asp Leu Val Val Gly Asn Thr Leu Glu Ala Phe Gly Ser Glu Glu
355 360 365

Asn Gln Val Val Leu Ile Gly Arg Asp Phe Thr Lys Glu Leu Pro Lys
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Met Lys Lys Arg Glu Leu Ala Glu Arg Ile Trp Asp Glu Ile Glu Lys
 385 390 395 400

Xaa Leu Ser

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 gagcttgctc aactttatc 19

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 cgggatatcg acatttctgc acc 23

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<400> 29
gagttaaatg cctacactgt atct

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<210> 30

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caggactcag aagctgctat cgaa

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Arg Lys Glu Lys Ser Xaa Phe Leu Gln Gly Asn
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Lys Glu Gly Lys Val Xaa Ile Pro Pro Arg Glu
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Lys Gly Arg Lys Ser Arg Tyr Ser Ser Lys Gly Leu
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ttaatttaa 129

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Lys Ile Arg Lys Glu Ile Leu Ile Glu Pro Phe Ser Glu Glu Trp Leu
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Gln Pro Ala Gly Tyr Asp Leu Arg Val Gly
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 ttgggttgac ccaggatggg atggaaactt aacactaatg ctctacaatg cctcaaataga 180
 acctgtcgaa ttaagatatg gagagagatt tgtgcagatc gcattttataa ggctagaggg 240
 tccggcaaga aacccttaca gaggaaacta tcaggggagc acaagggttag cgttttcaaa 300
 gagaaagaaa ctctagcgtc ttttcaatag catcctcaat atctcgtgtg aagtaatcaa 360
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 cactagttcc aaaagatatt gtttgcgtag ttaccaacaa gatcttggca ttatttttga 540
 tcttatactc tattctcctt tctccctcca atttgcccaa aataaacctg ggtagtatac 600
 attcactcct ctctttttaa ttcctataaa ttcgtacata gtttagaaaa atgtcaaatt 660
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 aaccctaat tttccccttn 740

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 20 25 30
 Lys Gly Leu Leu Val Leu Leu Leu Gly Leu Thr Gln Asp Gly Met Glu
 35 40 45
 Thr Xaa His Xaa Cys Ser Thr Met Pro Gln Met Asn Leu Ser Asn Xaa
 50 55 60
 Asp Met Glu Arg Asp Leu Cys Arg Ser His Leu Xaa Gly Xaa Arg Val
 65 70 75 80
 Arg Gln Glu Thr Leu Thr Glu Glu Thr Ile Arg Gly Ala Gln Gly Xaa
 85 90 95
 Arg Phe Gln Arg Glu Arg Asn Ser Ser Val Phe Ser Ile Ala Ser Ser
 100 105 110
 Ile Ser Arg Val Lys Xaa Ser Met Xaa Ile Leu Ala Gly Trp Val Phe
 115 120 125
 Arg Asp Ser Asn Ser Xaa Asp Gly Pro Val Xaa Gln Lys Thr Ile Phe
 130 135 140
 Ala Ser Ser Ser Phe Ile Phe Leu Xaa Ile Lys Asn Pro Thr Ser Thr
 145 150 155 160
 Leu Val Pro Lys Asp Ile Val Cys Val Ile Thr Asn Lys Ile Leu Ala
 165 170 175
 Leu Phe Leu Ile Leu Tyr Ser Ile Leu Leu Ser Pro Ser Asn Leu Pro
 180 185 190
 Lys Ile Asn Leu Gly Ser Ile His Ser Leu Leu Ser Phe Lys Phe Leu
 195 200 205
 Xaa Ile Arg Thr Xaa Phe Arg Lys Met Ser Asn Ser Xaa Phe Pro Val
 210 215 220
 Lys Leu Thr Xaa Lys Ser Leu Xaa Xaa Xaa Phe Leu Xaa Phe Pro Lys
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Pro Asn Asn Val Met Gly Asp Met Lys Ile Arg Ser Ser Leu Ala Arg
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Glu Gly Val Ile Gly Ser Phe Ala Trp Val Asp Pro Gly Trp Asp Gly
35 40 45

Asn Leu Thr Leu Met Leu Tyr Asn Ala Ser Asn Glu Pro Val Glu Leu
50 55 60

Arg Tyr Gly Glu Arg Phe Val Gln Ile Ala Phe Ile Arg Leu Glu Gly
65 70 75 80

Pro Ala Arg Asn Pro Tyr Arg Gly Asn Tyr Gln Gly Ser Thr Arg Leu
85 90 95

Ala Phe Ser Lys Arg Lys Lys Leu Xaa Arg Leu Phe Asn Ser Ile Leu
100 105 110

Asn Ile Ser Cys Glu Val Ile Asn Val Asn Thr Cys Trp Val Gly Phe
115 120 125

Xaa Gly Phe Lys Leu Val Arg Trp Ala Cys Ile Ala Glu Asn Tyr Phe
130 135 140

Cys Leu Phe Phe Ile Tyr Leu Ser Val Asn Lys Lys Ser Asn Ile His
145 150 155 160

Thr Ser Ser Lys Arg Tyr Cys Leu Arg Asp Tyr Gln Gln Asp Leu Gly
165 170 175

Ile Ile Phe Asp Leu Ile Leu Tyr Ser Pro Phe Ser Leu Gln Phe Ala
180 185 190

Gln Asn Lys Pro Gly Xaa Tyr Thr Phe Thr Pro Leu Phe Xaa Ile Pro
195 200 205

Ile Asn Ser Tyr Ile Val Xaa Lys Asn Val Lys Phe Phe Xaa Pro Cys
210 215 220

Xaa Ile Asn Xaa Xaa Ile Phe Xaa Xaa Xaa Leu Phe Ile Ile Pro Lys
225 230 235 240

Thr Pro Asn Phe Pro Leu
245

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Ala Arg Arg Cys Tyr Gly Gly Tyr Glu Asp Lys Glu Gln Phe Ser Lys
20 25 30

Arg Arg Gly Tyr Trp Phe Phe Cys Leu Gly Xaa Pro Arg Met Gly Trp
35 40 45

Lys Leu Asn Thr Asn Ala Leu Gln Cys Leu Lys Xaa Thr Cys Arg Ile
50 55 60

Lys Ile Trp Arg Glu Ile Cys Ala Asp Arg Ile Tyr Lys Ala Arg Gly
65 70 75 80

Ser Gly Lys Lys Pro Leu Gln Arg Lys Leu Ser Gly Glu His Lys Val
85 90 95

Ser Val Phe Lys Glu Lys Glu Thr Leu Ala Ser Phe Gln Xaa His Pro
100 105 110

Gln Tyr Leu Val Xaa Ser Asn Gln Cys Lys Tyr Leu Leu Gly Gly Phe
115 120 125

Leu Gly Ile Gln Thr Arg Lys Met Gly Leu Tyr Ser Arg Lys Leu Phe
130 135 140

Leu Pro Leu Leu His Leu Ser Phe Cys Glu Xaa Lys Ile Gln His Pro
145 150 155 160

His Xaa Phe Gln Lys Ile Leu Phe Ala Xaa Leu Pro Thr Arg Ser Trp
165 170 175

His Tyr Phe Xaa Ser Tyr Thr Leu Phe Ser Phe Leu Pro Pro Ile Cys
180 185 190

Pro Lys Xaa Thr Trp Val Val Tyr Ile His Ser Ser Leu Leu Asn Ser
195 200 205

Tyr Lys Phe Val His Ser Leu Glu Lys Cys Gln Ile Leu Xaa Ser Leu
210 215 220

Leu Asn Xaa Pro Xaa Asn Leu Tyr Xaa Xaa Xaa Phe Tyr Asn Ser Gln
 225 230 235 240

Asn Pro Xaa Phe Ser Pro
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<400> 46

Met Leu His His Val Lys Leu Ile Tyr Ala Thr Lys Ser Arg Lys Leu
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Val Gly Lys Lys Ile Val Xaa Xaa Xaa Pro Gly Ser Ile Ala Ala
 20 25 30

<210> 47
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<400> 47

Lys Tyr Asp Val Val Ile Met Ala Ala Ala Val Ser Asp Phe Arg Phe
 1 5 10 15

Lys

<210> 48
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<400> 48

Ala Asp Leu Val Val Gly Asn Thr Leu Glu Ala Phe Gly Ser Glu Glu
 1 5 10 15

Asn Gln Val Val Leu Ile Gly Arg
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21

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Ser Lys Leu Leu Glu Asn Lys Lys Ile Leu Val Ala Val Thr Ser Ser
20 25 30

Ile Ala Ala Ile Glu Thr Pro Lys Leu Met Arg Glu Leu Ile Arg His
35 40 45

Gly Ala Glu Val Tyr Cys Ile Ile Thr Glu Glu Thr Lys Lys Ile Ile
50 55 60

Gly Lys Glu Ala Leu Lys Phe Gly Cys Gly Asn Glu Val Tyr Glu Glu
65 70 75 80

Ile Thr Gly Xaa Xaa Xaa Xaa Xaa Asp Ile Glu His Ile Leu Leu Tyr
85 90 95

Xaa Xaa Xaa Xaa Asn Glu Cys Asp Cys Leu Leu Ile Tyr Pro Ala Thr
100 105 110

Ala Asn Ile Ile Ser Lys Ile Asn Leu Gly Ile Ala Asp Asn Ile Val
115 120 125

Asn Thr Thr Ala Leu Met Phe Phe Gly Asn Lys Pro Ile Phe Ile Val
130 135 140

Pro Ala Met His Glu Asn Met Phe Asn Xaa Xaa Ala Ile Lys Arg His
145 150 155 160

Ile Asp Lys Leu Lys Glu Lys Asp Lys Ile Tyr Ile Ile Ser Pro Lys
165 170 175

Phe Glu Glu Xaa Xaa Xaa Xaa Xaa Xaa Gly Lys Ala Lys Val Ala Asn
180 185 190

Ile Glu Asp Val Val Lys Ala Val Ile Glu Lys Ile Gly Asn Asn Leu
195 200 205

Lys Lys Glu Gly Asn Arg Val Leu Ile Leu Asn Gly Gly Thr Val Glu
210 215 220

Phe Ile Asp Lys Val Arg Val Ile Ser Asn Leu Ser Ser Gly Lys Met
225 230 235 240

Gly Val Ala Leu Ala Glu Ala Phe Cys Lys Glu Gly Phe Tyr Val Glu
245 250 255

Val Ile Thr Ala Met Gly Leu Glu Pro Pro Tyr Tyr Ile Lys Asn His
260 265 270

Lys Val Leu Thr Ala Lys Glu Met Leu Asn Lys Ala Ile Glu Xaa Xaa
275 280 285

Leu Xaa Ala Lys Asp Phe Asp Ile Ile Ile Ser Ser Ala Ala Ile Ser
290 295 300

Asp Phe Thr Val Glu Ser Xaa Phe Glu Gly Lys Leu Ser Ser Glu Glu
305 310 315 320

Glu Xaa Xaa Xaa Xaa Leu Ile Leu Lys Leu Lys Arg Xaa Asn Pro Lys
325 330 335

Val Leu Glu Glu Leu Arg Arg Ile Tyr Lys Asp Xaa Lys Val Ile Ile
340 345 350

Gly Phe Lys Ala Glu Tyr Asn Leu Asp Glu Lys Glu Leu Ile Asn Arg
355 360 365

Ala Lys Glu Arg Leu Asn Lys Tyr Asn Leu Asn Met Ile Ile Ala Asn
370 375 380

Asp Leu Ser Lys Xaa Xaa His Tyr Phe Gly Asp Asp Tyr Ile Glu Val
385 390 395 400

Tyr Ile Ile Thr Lys Tyr Glu Val Glu Lys Ile Ser Gly Ser Lys Lys
405 410 415

Xaa Glu Ile Ser Glu Arg Ile Val Glu Lys Val Lys Lys Leu Val Lys
420 425 430

Ser Xaa Xaa Xaa Xaa
435

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Cys His Pro Thr Gly Lys Ile Ile Met Ser Leu Ala Gly Lys Lys Ile
20 25 30

Val Leu Gly Val Ser Gly Gly Ile Ala Ala Tyr Lys Thr Pro Glu Leu
35 40 45

Val Arg Arg Leu Arg Asp Arg Gly Ala Asp Val Arg Val Ala Met Thr
50 55 60

Glu Ala Ala Lys Ala Phe Ile Thr Pro Leu Ser Leu Gln Ala Val Ser
65 70 75 80

Gly Tyr Pro Val Ser Asp Ser Leu Leu Asp Pro Ala Ala Glu Ala Ala
85 90 95

Met Gly His Ile Glu Leu Gly Xaa Xaa Xaa Xaa Lys Trp Ala Asp Leu
100 105 110

Val Ile Leu Ala Pro Ala Thr Ala Asp Leu Ile Ala Arg Val Ala Ala
115 120 125

Gly Met Ala Asn Asp Leu Val Ser Thr Ile Cys Leu Ala Thr Pro Xaa
130 135 140

Xaa Ala Pro Val Ala Val Leu Pro Ala Met Asn Gln Gln Met Tyr Arg
145 150 155 160

Ala Ala Ala Thr Gln His Asn Leu Glu Val Leu Ala Xaa Ser Arg Gly
165 170 175

Leu Leu Ile Trp Gly Pro Asp Ser Gly Ser Gln Ala Cys Gly Asp Ile
180 185 190

Gly Pro Gly Arg Xaa Xaa Asp Pro Leu Thr Ile Val Asp Met Ala Val
195 200 205

Ala His Phe Ser Pro Val Asn Asp Leu Lys His Leu Asn Ile Met Ile
210 215 220

Thr Ala Gly Pro Thr Arg Glu Pro Leu Asp Pro Val Arg Tyr Ile Ser
225 230 235 240

Asn His Ser Ser Gly Lys Met Gly Phe Ala Ile Ala Ala Ala Ala Ala
245 250 255

Arg Arg Gly Ala Asn Val Thr Leu Val Ser Gly Pro Val Ser Leu Pro
260 265 270

Thr Pro Pro Phe Val Lys Arg Val Asp Val Met Thr Ala Leu Glu Met
275 280 285

Glu Ala Ala Val Asn Xaa Xaa Ala Ser Val Gln Gln Gln Asn Ile Phe
290 295 300

Ile Gly Cys Ala Ala Val Ala Asp Tyr Arg Ala Ala Thr Val Ala Pro
305 310 315 320

Glu Lys Ile Lys Lys Gln Ala Thr Gln Gly Asp Glu Leu Thr Ile Lys
325 330 335

Met Val Lys Xaa Asn Pro Asp Ile Val Ala Gly Val Ala Ala Leu Lys
340 345 350

Asp His Arg Pro Tyr Val Val Gly Phe Ala Ala Glu Thr Asn Asn Xaa
355 360 365

Xaa Xaa Xaa Val Glu Glu Tyr Ala Arg Gln Lys Arg Ile Arg Lys Asn
370 375 380

Leu Asp Leu Ile Cys Ala Asn Asp Val Ser Gln Pro Thr Gln Gly Phe
385 390 395 400

Asn Ser Asp Asn Asn Ala Leu His Leu Phe Trp Gln Asp Gly Asp Lys
405 410 415

Val Leu Pro Leu Glu Arg Lys Glu Leu Leu Gly Gln Leu Leu Leu Asp
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Phe Ala Trp Val Asp Pro Gly Trp Asp Gly Asn Thr Leu Met
1 5 10

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Ala Gly Trp Ile Asp Ala Gly Phe Lys Gly Lys Ile Thr Leu
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Ser Ala Val His Asp Pro Gly Tyr Glu Gly Arg Pro Glu Tyr
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<210> 57
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Pro Thr Ile Val Asp Ala Gly Phe Glu Gly Gln Leu Thr Ile
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Ala His Arg Ile Asp Pro Gly Trp Ser Gly Cys Ile Val Leu
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caggactcag aagctgctat cgaa

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ctgcacgtgc cctgtaggat ttgt

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ctattgagta cgaacgccat c

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gaggagagca ggaaaggtgg aac

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gctgggagaa gacttcactg g

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His His Val Lys Leu Ile Tyr Ala
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Lys Tyr Asp Ala Val Ile Met Ala
1 5

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Glu Glu Asn Gln Val Val Leu
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Pro Asp Trp Lys Ile Arg Lys Glu

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tcgctccaac cagcaggtta tgacctcaga gtgggcagag aggcttttgt taaggggaaa 120
ttaatcgacg tggaaaagga aggaaaagtc gttattcctc caagggaata cgccttaatc 180
ctaaccctcg agaggataaa gttgcccgcac gatgttatgg gggatatgaa gataaggagc 240
agtttagcaa gagaaggggt tattggttct ttgcttggg ttgaccagg atgggatgga 300
aacttaacac taatgctcta caatgcctca aatgaacctg tcgaattaag atatggagag 360
agatttgtgc agatcgcat tataaggcta gaggggtccg caagaaacc ttacagagga 420
aactatcagg ggagcacaag gttagcgttt tcaaagagaa agaaactcta g 471

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<213> *Pyrococcus furiosus*

<400> 71

Met Leu Leu Pro Asp Trp Lys Ile Arg Lys Glu Ile Leu Ile Glu Pro
1 5 10 15

Phe Ser Glu Glu Ser Leu Gln Pro Ala Gly Tyr Asp Leu Arg Val Gly
20 25 30

Arg Glu Ala Phe Val Lys Gly Lys Leu Ile Asp Val Glu Lys Glu Gly
35 40 45

Lys Val Val Ile Pro Pro Arg Glu Tyr Ala Leu Ile Leu Thr Leu Glu
50 55 60

Arg Ile Lys Leu Pro Asp Asp Val Met Gly Asp Met Lys Ile Arg Ser
65 70 75 80

Ser Leu Ala Arg Glu Gly Val Ile Gly Ser Phe Ala Trp Val Asp Pro
85 90 95

Gly Trp Asp Gly Asn Leu Thr Leu Met Leu Tyr Asn Ala Ser Asn Glu
100 105 110

Pro Val Glu Leu Arg Tyr Gly Glu Arg Phe Val Gln Ile Ala Phe Ile
115 120 125

Arg Leu Glu Gly Pro Ala Arg Asn Pro Tyr Arg Gly Asn Tyr Gln Gly
 130 135 140

Ser Thr Arg Leu Ala Phe Ser Lys Arg Lys Lys Leu
 145 150 155

<210> 72
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<220>
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 <222> (3)..(4)
 <223> Xaa can be any naturally occurring amino acid

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 <223> Xaa can be any naturally occurring amino acid

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 1 5 10

<210> 73
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 <212> PRT
 <213> Pyrococcus furiosus

<400> 73

Phe Ala Trp Val Asp Pro Gly Trp Asp Gly Asn Thr Leu Met
 1 5 10

<210> 74
 <211> 14
 <212> PRT
 <213> Methanococcus jannaschii

<400> 74

Ala Gly Trp Ile Asp Ala Gly Phe Lys Gly Lys Ile Thr Leu
 1 5 10

<210> 75
<211> 14
<212> PRT
<213> Methanococcus jannaschii
<400> 75

Ser Ala Val His Asp Pro Gly Tyr Glu Gly Arg Pro Glu Tyr
1 5 10

<210> 76
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Pro Thr Ile Val Asp Ala Gly Phe Glu Gly Gln Leu Thr Ile
1 5 10

<210> 77
<211> 14
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<213> Escherichia coli
<400> 77

Ala His Arg Ile Asp Pro Gly Trp Ser Gly Cys Ile Val Leu
1 5 10

<210> 78
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<400> 78

Val Gly Leu Ile Asp Ser Asp Tyr Gln Gly Gln Leu Met Ile
1 5 10

<210> 79
<211> 14
<212> PRT
<213> Saccharomyces cerevisiae
<400> 79

Ala Gly Val Val Asp Arg Asp Tyr Thr Gly Glu Val Lys Val
1 5 10

<210> 80
<211> 14
<212> PRT
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Ala Gly Val Ile Asp Glu Asp Tyr Arg Gly Asn Val Gly Val
1 5 10

<210> 81
<211> 14
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<400> 81

Thr Gly Leu Ile Asp Pro Gly Phe Gln Gly Glu Leu Lys Leu
1 5 10

<210> 82
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gacgacgaca agatgctact tccagactgg aaa

33

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<400> 83
ggaacaagac ccgtcccact ttcacagatg aagag

35

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<212> DNA
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<220>
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<400> 84
gaggagagca ggaaaggtgg aac

23

<210> 85
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<220>
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<400> 85
ctccatgtcc caactccgat cac

23

<210> 86

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<400> 86
ggttttccca gtcacgacgt tgtaaaacga cggccagt 38

<210> 87
<211> 29
<212> DNA
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<220>
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<400> 87
ggcccagcac gacggaaaac gacggccag 29

<210> 88
<211> 35
<212> DNA
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<220>
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<400> 88
gacgacgaca agatgccctg ctctgaagag acacc 35

<210> 89
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<400> 89
ggaacaagac ccgtttaatt ctttccagtgaacc 35

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<212> PRT
<213> Desulfurolobus ambivalens

<400> 90

Met Ile Leu Gly Asp Arg Asp Leu Lys Tyr Tyr Leu Glu Lys Gly Trp
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Ile Val Ile Ser Pro Leu Thr Gln Asp Thr Ile Arg Glu Asn Gly Val
20 25 30

Asp Leu Arg Val Gly Gly Glu Ile Ala Arg Phe Lys Lys Thr Asp Glu
35 40 45

Ile Tyr Glu Asp Gly Lys Asp Pro Arg Ser Phe Tyr Glu Ile Glu Lys
50 55 60

Gly Asp Glu Phe Ile Ile Tyr Pro Asn Glu His Val Leu Leu Val Thr
65 70 75 80

Glu Glu Tyr Val Lys Leu Pro Asn Asp Val Met Ala Phe Val Asn Leu
85 90 95

Arg Ser Ser Phe Ala Arg Leu Gly Leu Phe Val Pro Pro Thr Ile Val
100 105 110

Asp Ala Gly Phe Glu Gly Gln Leu Thr Ile Glu Val Leu Gly Ser Ala
115 120 125

Phe Pro Val Lys Ile Lys Arg Gly Thr Arg Phe Leu His Leu Ile Phe
130 135 140

Ala Arg Thr Leu Thr Pro Val Glu Asn Pro Tyr His Gly Lys Tyr Gln
145 150 155 160

Gly Gln Gln Gly Val Thr Leu Pro Lys Phe Lys Phe Arg
165 170

<210> 91
<211> 193
<212> PRT
<213> Escherichia coli

<400> 91

Met Arg Leu Cys Asp Arg Asp Ile Glu Ala Trp Leu Asp Glu Gly Arg
1 5 10 15

Leu Ser Ile Asn Pro Arg Pro Pro Val Glu Arg Ile Asn Gly Ala Thr
20 25 30

Val Asp Val Arg Leu Gly Asn Lys Phe Arg Thr Phe Arg Gly His Thr
35 40 45

Ala Ala Phe Ile Asp Leu Ser Gly Pro Lys Asp Glu Val Ser Ala Ala
50 55 60

Leu Asp Arg Val Met Ser Asp Glu Ile Val Leu Asp Glu Gly Glu Ala
65 70 75 80

Phe Tyr Leu His Pro Gly Glu Leu Ala Leu Ala Val Thr Leu Glu Ser
85 90 95

Val Thr Leu Pro Ala Asp Leu Val Gly Trp Leu Asp Gly Arg Ser Ser
100 105 110

Leu Ala Arg Leu Gly Leu Met Val His Val Thr Ala His Arg Ile Asp
115 120 125

Pro Gly Trp Ser Gly Cys Ile Val Leu Glu Phe Tyr Asn Ser Gly Lys
130 135 140

Leu Pro Leu Ala Leu Arg Pro Gly Met Leu Ile Gly Ala Leu Ser Phe
145 150 155 160

Glu Pro Leu Ser Gly Pro Ala Val Arg Pro Tyr Asn Arg Arg Glu Asp
165 170 175

Ala Lys Tyr Arg Asn Gln Gln Gly Ala Val Ala Ser Arg Ile Asp Lys
180 185 190

Asp

<210> 92
<211> 195
<212> PRT
<213> Haemophilus influenzae

<220>
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<222> (167)..(167)
<223> Xaa can be any naturally occurring amino acid

<400> 92

Met Arg Leu Cys Asp Thr Asp Ile Glu Arg Tyr Leu Asp Asp Gly Ile
1 5 10 15

Ile Ser Leu Thr Pro Arg Pro Asn Asn Asp Lys Ile Asn Gly Ala Thr
20 25 30

Ile Asp Val Arg Leu Gly Asn Ser Phe Arg Val Phe Arg Glu His Ser
35 40 45

Ala Pro Phe Ile Asp Leu Ser Gly Pro Lys Glu Glu Val Ser Ala Gln
50 55 60

Leu Glu Ser Val Met Ser Asp Glu Ile Ile Ile Pro Glu Gly Glu Ala
65 70 75 80

Phe Phe Leu His Pro Gly Thr Leu Ala Leu Ala Thr Thr Leu Glu Ser
85 90 95

Val Lys Leu Pro Ala Asn Ile Ile Gly Trp Leu Asp Gly Arg Ser Ser
100 105 110

Leu Ala Arg Leu Gly Leu Met Val His Val Thr Ala His Arg Ile Asp
115 120 125

Pro Gly Trp Glu Gly Lys Ile Val Leu Glu Phe Tyr Asn Ser Gly Lys
130 135 140

Leu Pro Leu Ala Leu Arg Pro Asn Met Val Ile Gly Ala Leu Ser Phe
145 150 155 160

Glu Val Leu Ser Gly Glu Xaa Lys Arg Pro Tyr Ser Ser Arg Lys Asp
165 170 175

Ala Lys Tyr Lys Asn Gln Gln Ser Ala Val Ala Ser Arg Ile Asp Glu
180 185 190

Asp Lys Glu
195

<210> 93
<211> 139
<212> PRT
<213> Bacteriophage r1t

<400> 93

Met Thr Arg Gly Phe Lys Lys Leu Asn Glu Asn Ala Thr Ile Pro Glu
1 5 10 15

Arg Ala Thr Glu His Ser Ala Gly Tyr Asp Ile Ser Ala Ser Glu Thr
20 25 30

Val Thr Ile Gln Pro Asp Glu Ile Lys Met Val Ser Thr Gly Leu Ala
35 40 45

Val Gln Leu Gly Asp Asp Glu Val Leu Lys Leu Tyr Asp Arg Ser Ser
50 55 60

Asn Pro Val Lys Arg Gly Ile Ala Leu Ile Asn Ser Val Gly Ile Ile
65 70 75 80

Asp Ser Asp Tyr Tyr Pro Gln Glu Phe Lys Gly Leu Phe Met Asn Ile
85 90 95

Ser Lys Glu Pro Val Thr Ile Ser Lys Gly Gln Arg Ile Met Gln Gly
100 105 110

Val Phe Val Lys Tyr Leu Thr Thr Asn Asp Asp Asn Ala Asn Gly Lys
115 120 125

Arg Thr Gly Gly Phe Gly Ser Thr Gly Glu Val
130 135

<210> 94
<211> 151
<212> PRT
<213> Escherichia coli

<400> 94

Met Lys Lys Ile Asp Val Lys Ile Leu Asp Pro Arg Val Gly Lys Glu
1 5 10 15

Phe Pro Leu Pro Thr Tyr Ala Thr Ser Gly Ser Ala Gly Leu Asp Leu
20 25 30

Arg Ala Cys Leu Asn Asp Ala Val Glu Leu Ala Pro Gly Asp Thr Thr
35 40 45

Leu Val Pro Thr Gly Leu Ala Ile His Ile Ala Asp Pro Ser Leu Ala
50 55 60

Ala Met Met Leu Pro Arg Ser Gly Leu Gly His Lys His Gly Ile Val
65 70 75 80

Leu Gly Asn Leu Val Gly Leu Ile Asp Ser Asp Tyr Gln Gly Gln Leu
85 90 95

Met Ile Ser Val Trp Asn Arg Gly Gln Asp Ser Phe Thr Ile Gln Pro
100 105 110

Gly Glu Arg Ile Ala Gln Met Ile Phe Val Pro Val Val Gln Ala Glu
115 120 125

Phe Asn Leu Val Glu Asp Phe Asp Ala Thr Asp Arg Gly Glu Gly Gly
130 135 140

Phe Gly His Ser Gly Arg Gln
145 150

<210> 95
<211> 151
<212> PRT
<213> Haemophilus influenzae

<400> 95

Met Lys Lys Ile Asp Val Lys Ile Leu Asp Ser Arg Ile Gly Asn Glu
Page 42

Ala Gly Val Val Asp Arg Asp Tyr Thr Gly Glu Val Lys Val Val Leu
85 90 95

Phe Asn His Ser Gln Arg Asp Phe Ala Ile Lys Lys Gly Asp Arg Val
100 105 110

Ala Gln Leu Ile Leu Glu Lys Ile Val Asp Asp Ala Gln Ile Val Val
115 120 125

Val Asp Ser Leu Glu Glu Ser Ala Arg Gly Ala Gly Gly Phe Gly Ser
130 135 140

Thr Gly Asn
145

<210> 97
<211> 142
<212> PRT
<213> Swinepox virus

<400> 97

Met Ser Leu Tyr Val Lys Cys Val Lys Leu Ser Asn Asn Ala Ile Ile
1 5 10 15

Pro Asn Arg Ser Met Ser Gly Ser Ala Gly Tyr Asp Leu Tyr Ser Ala
20 25 30

Tyr Ser Tyr Thr Val Lys Pro Tyr Asn Arg Ile Leu Val Arg Thr Asp
35 40 45

Ile Cys Leu Met Ile Pro Asp Lys Cys Tyr Gly Arg Ile Ser Pro Arg
50 55 60

Ser Gly Leu Ser Leu Asn Tyr Asn Ile Asp Ile Gly Gly Gly Val Ile
65 70 75 80

Asp Ser Asp Tyr Arg Gly Glu Ile Gly Ile Val Phe Ile Asn Asn Gly
85 90 95

Cys Ser Asp Phe Asn Ile Lys Val Gly Asp Arg Ile Ala Gln Ile Ile
100 105 110

Phe Glu Arg Val Glu Tyr Pro Ile Met Glu Glu Val Lys Cys Leu Glu
115 120 125

Asp Thr Glu Arg Gly Asn Ser Gly Phe Gly Ser Ser Gly Met
130 135 140

<210> 98
 <211> 169
 <212> PRT
 <213> Lycopersicon esculentum

<400> 98

Met Ala Glu Asn Gln Ile Asn Ser Pro Glu Ile Thr Glu Pro Ser Pro
 1 5 10 15

Lys Val Gln Lys Leu Asp His Pro Glu Asn Gly Asn Val Pro Phe Phe
 20 25 30

Arg Val Lys Lys Leu Ser Glu Asn Ala Val Leu Pro Ser Arg Ala Ser
 35 40 45

Ser Leu Ala Ala Gly Tyr Asp Leu Ser Ser Ala Ala Glu Thr Lys Val
 50 55 60

Pro Ala Arg Gly Lys Ala Leu Val Pro Thr Asp Leu Ser Ile Ala Val
 65 70 75 80

Pro Gln Gly Thr Tyr Ala Arg Ile Ala Pro Arg Ser Gly Leu Ala Trp
 85 90 95

Lys Tyr Ser Ile Asp Val Gly Ala Gly Val Ile Asp Ala Asp Tyr Arg
 100 105 110

Gly Pro Val Gly Val Val Leu Phe Asn His Ser Glu Val Asp Phe Glu
 115 120 125

Val Lys Val Gly Asp Arg Ile Ala Gln Leu Ile Val Gln Lys Ile Val
 130 135 140

Thr Pro Glu Val Glu Gln Val Asp Asp Leu Asp Ser Thr Val Arg Gly
 145 150 155 160

Ser Gly Gly Phe Gly Ser Thr Gly Val
 165

<210> 99
 <211> 147
 <212> PRT
 <213> Variola virus

<400> 99

Met Phe Asn Met Asn Ile Asn Ser Pro Val Arg Phe Val Lys Glu Thr
 1 5 10 15

Asn Arg Ala Lys Ser Pro Thr Arg Gln Ser Pro Tyr Ala Ala Gly Tyr
 Page 45

20

25

30

Asp Leu Tyr Ser Ala Tyr Asp Tyr Thr Ile Pro Pro Gly Glu Arg Gln
 35 40 45

Leu Ile Lys Thr Asp Ile Ser Met Ser Met Pro Lys Phe Cys Tyr Gly
 50 55 60

Arg Ile Ala Pro Arg Ser Gly Leu Ser Leu Lys Gly Ile Asp Ile Gly
 65 70 75 80

Gly Gly Val Ile Asp Glu Asp Tyr Arg Gly Asn Ile Gly Val Ile Leu
 85 90 95

Ile Asn Asn Gly Lys Tyr Thr Phe Asn Val Asn Thr Gly Asp Arg Ile
 100 105 110

Ala Gln Leu Ile Tyr Gln Arg Ile Tyr Tyr Pro Glu Leu Lys Glu Val
 115 120 125

Gln Ser Leu Asp Ser Thr Asp Arg Gly Asp Gln Gly Phe Gly Ser Thr
 130 135 140

Gly Leu Arg
 145

<210> 100
 <211> 159
 <212> PRT
 <213> orf virus

<400> 100

Met Glu Phe Cys His Thr Glu Thr Leu Gln Val Val Arg Leu Ser Gln
 1 5 10 15

Asn Ala Thr Ile Pro Ala Arg Gly Ser Pro Gly Ala Ala Gly Leu Asp
 20 25 30

Leu Cys Ser Ala Tyr Asp Cys Val Ile Pro Ser His Cys Ser Arg Val
 35 40 45

Val Phe Thr Asp Leu Leu Ile Lys Pro Pro Ser Gly Cys Tyr Gly Arg
 50 55 60

Ile Ala Pro Arg Ser Gly Leu Ala Val Lys His Phe Ile Asp Val Gly
 65 70 75 80

Ala Gly Val Ile Asp Glu Asp Tyr Arg Gly Asn Val Gly Val Val Leu
 85 90 95

Phe Asn Phe Gly Asn Ser Asp Phe Glu Val Lys Lys Gly Asp Arg Ile
100 105 110

Ala Gln Leu Ile Cys Glu Arg Ile Ser Cys Pro Ala Val Gln Glu Val
115 120 125

Asn Cys Leu Asp Asn Thr Asp Arg Gly Asp Ser Gly Phe Gly Ser Thr
130 135 140

Gly Ser Gly Ala Cys Gly Gly Arg Asp Thr Ala Trp Tyr Ile Ser
145 150 155

<210> 101
<211> 164
<212> PRT
<213> Homo sapiens

<400> 101

Met Pro Cys Ser Glu Glu Thr Pro Ala Ile Ser Pro Ser Lys Arg Ala
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Arg Pro Ala Glu Val Gly Gly Met Gln Leu Arg Phe Ala Arg Leu Ser
20 25 30

Glu His Ala Thr Ala Pro Thr Arg Gly Ser Ala Arg Ala Ala Gly Tyr
35 40 45

Asp Leu Tyr Ser Ala Tyr Asp Tyr Thr Ile Pro Pro Met Glu Lys Ala
50 55 60

Val Val Lys Thr Asp Ile Gln Ile Ala Leu Pro Ser Gly Cys Tyr Gly
65 70 75 80

Arg Val Ala Pro Arg Ser Gly Leu Ala Ala Lys His Phe Ile Asp Val
85 90 95

Gly Ala Gly Val Ile Asp Glu Asp Tyr Arg Gly Asn Val Gly Val Val
100 105 110

Leu Phe Asn Phe Gly Lys Glu Lys Phe Glu Val Lys Lys Gly Asp Arg
115 120 125

Ile Ala Gln Leu Ile Cys Glu Arg Ile Phe Tyr Pro Glu Ile Glu Glu
130 135 140

Val Gln Ala Leu Asp Asp Thr Glu Arg Gly Ser Gly Gly Phe Gly Ser
145 150 155 160

Thr Gly Lys Asn

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<211> 203

<212> PRT

<213> rat

<400> 102

Met Pro Val Leu Cys Ala Leu Pro Arg Pro Thr Pro Thr Phe Ser Ala
1 5 10 15

Pro Leu Ala Tyr Ala His Val Arg Ala Lys Pro Lys Leu Arg Arg Lys
20 25 30

Gln Arg Ser Pro Asp Leu Glu Arg Ala Asp Arg Thr Arg Ser Ala Asp
35 40 45

Pro Ala Val Ser Val Ser Lys Arg Ala Arg Ala Glu Asp Asp Ala Ser
50 55 60

Leu Arg Phe Val Arg Leu Ser Glu His Ala Thr Ala Pro Thr Arg Gly
65 70 75 80

Ser Ala Arg Ala Ala Gly Tyr Asp Leu Tyr Ser Ala Tyr Asp Tyr Thr
85 90 95

Ile Pro Ser Met Glu Lys Ala Leu Val Lys Thr Asp Ile Gln Ile Ala
100 105 110

Val Pro Ser Gly Cys Tyr Gly Arg Val Ala Pro Arg Ser Gly Leu Ala
115 120 125

Val Lys His Phe Ile Asp Val Gly Ala Gly Val Ile Asp Glu Asp Tyr
130 135 140

Arg Gly Asn Val Gly Val Val Leu Phe Asn Phe Gly Lys Glu Lys Phe
145 150 155 160

Glu Val Lys Lys Gly Asp Arg Ile Ala Gln Leu Ile Cys Glu Arg Ile
165 170 175

Leu Tyr Pro Asp Leu Glu Glu Val Gln Thr Leu Asp Asn Thr Glu Arg
180 185 190

Gly Ser Gly Gly Phe Gly Ser Thr Gly Lys Asn
195 200

<210> 103
 <211> 206
 <212> PRT
 <213> Equine infectious anemia virus

<400> 103

Ile Cys Gly Asn Gln Leu Ala Asp Glu Ala Ala Lys Ile Lys Glu Glu
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Ile Met Leu Ala Tyr Gln Gly Thr Gln Ile Lys Glu Lys Arg Asp Glu
 20 25 30

Asp Ala Gly Phe Asp Leu Cys Val Pro Tyr Asp Ile Met Ile Pro Val
 35 40 45

Ser Asp Thr Lys Ile Ile Pro Thr Asp Val Lys Ile Gln Val Pro Pro
 50 55 60

Asn Ser Phe Gly Trp Val Thr Gly Lys Ser Ser Met Ala Lys Gln Gly
 65 70 75 80

Leu Leu Ile Asn Gly Gly Ile Ile Asp Glu Gly Tyr Thr Gly Glu Ile
 85 90 95

Gln Val Ile Cys Thr Asn Ile Gly Lys Gly Asn Ile Lys Leu Ile Glu
 100 105 110

Gly Gln Lys Phe Ala Gln Leu Ile Ile Leu Gln His His Ser Asn Ser
 115 120 125

Arg Gln Pro Trp Asp Glu Asn Lys Ile Ser Gln Arg Gly Asp Lys Gly
 130 135 140

Phe Gly Ser Thr Gly Val Phe Trp Val Glu Asn Ile Gln Glu Ala Gln
 145 150 155 160

Asp Glu His Glu Asn Trp His Thr Ser Pro Lys Ile Leu Ala Arg Asn
 165 170 175

Tyr Lys Ile Pro Leu Thr Val Ala Lys Gln Ile Thr Gln Glu Cys Pro
 180 185 190

His Cys Thr Lys Gln Gly Ser Gly Pro Ala Gly Cys Val Met
 195 200 205

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<400> 104

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Arg Ala Ser Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Ala Xaa Xaa Xaa
 20 25 30

Xaa Xaa Xaa Ala Gly Tyr Asp Leu Xaa Ser Ala Tyr Xaa Xaa Xaa Xaa
 35 40 45

Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Xaa Asp
 50 55 60

Xaa Xaa Xaa Thr Ile Pro Pro Xaa Glu Xaa Xaa Leu Val Xaa Thr Asp
 65 70 75 80

Leu Xaa Ile Xaa Leu Pro Xaa Xaa Xaa Tyr Gly Arg Met Ala Xaa Pro
 85 90 95

Arg Ser Gly Leu Ala Val Lys Arg Xaa Ile Asp Leu Gly Gly Xaa Xaa
 100 105 110

Gly Val Ile Asp Xaa Asp Tyr Arg Gly Asn Xaa Leu Gly Val Val Leu
115 120 125

Tyr Asn Xaa Gly Xaa Glu Xaa Phe Xaa Leu Lys Xaa Gly Asp Arg Ile
130 135 140

Ala Gln Leu Ile Phe Xaa Arg Ile Leu Xaa Pro Glu Xaa Ile Xaa Xaa
145 150 155 160

Val Xaa Xaa Leu Asp Xaa Thr Asp Arg Gly Xaa Gly Gly Phe Gly Ser
165 170 175

Thr Gly